# TAXONOMIC TYPE NAMES AND IDENTIFICATION TERMS USED FOR IMMATURE INSECTS.[1]

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Article 47 of the Entomological Code of Banks and Caudell states that "A specific name given to any part . . . or stage (except egg) of an insect is valid if otherwise available." It is further indicated in Article 48 that "A specific name based wholly on a cocoon, case, gall, leaf-mine, or other work of an insect is valid, if otherwise available, only until the insect itself is described, when that name and authority replaces the one based on the work." Although insects are now only rarely described from their immature stages it has been done to some extent in the past. Because of this there are many collections with specimens of such described insects. These, accordingly, represent type material. Few are aware that methods of designating such types are available.

The term *nepionic* (Gr. *nepios*—an infant) is defined in Torre-Bueno's Glossary of Entomology as "that stage of development immediately succeeding the embryonic; proposed as a substitute for larval." By this definition, it is obvious that the term must apply to both larvae and nymphs and precludes the pupal stage. From this term, we have had proposed by Alexander (1920, Cornell Memoir, 38: 743) the word *nepionotype* to designate a type larva. Although this type designation is not included in Torre-Bueno's glossary, it does occur in Fernald's (1939, Ann. Ent. Soc. Amer., 32: 697) list of type names which was compiled for him by Alexander. Also in Torre-Bueno's glossary the term *neanic* (Gr. *nearos*—youthful) is defined as "referring to the pupal stage." From this word there has also been derived the term *neanotype,* proposed by Alexander (*l.c.*), to refer to the type of a species described from a pupa. Fernald's list (*l.c.*) includes the name *ootype* of which it is pointed out that it is preoccupied as a morphological term in tapeworm nomenclature but which theoretically should be the type of an animal described from an egg. For the designation of an egg type this list indicates that such terms as *ovotype, ovoholotype* and *ovoparatype* can be used to designate type eggs.

Hopkins (1936, Mosquitoes of the Ethiopian Region, Vol. 1, p. 26) proposed the use of the term *paedotype* from the Latin *paedo* meaning child. He defines it as follows: "Paedotype is the type

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of any of the immature stages of an insect. It consists of the larva or pupa, of the larval or pupal skin, together with the adult insect bred from the same individual larva or pupa, in the case of the egg it may be either the whole egg together with the female which laid it, or the egg shell and the adult bred from it." Hopkins continues, "It will, of course, commonly happen that egg, larva and pupa are described at different times, in such cases there should be one paedotype for each stage. It is suggested that paedotypes should be indicated by a small circular green label attached to the specimen of each of the stages which make up the paedotype, and that this label should be inscribed to indicate whether the paedotype is of egg, larva or pupa. When possible, it is, of course, desirable to make the same adult serve as part of the paedotype for more than one of the early stages and it is clearly desirable that this adult should belong to the sex which is most readily identifiable. *Neo-paedotypes* may be designated when the original of an early stage was not made from material procured by the isolation method, or when it is no longer possible to associate the larval or pupal skin with the adult bred from it."

From these two sets of terms we see that they both have their uses. A *paedotype* is not as specific in meaning since it may be used for either larva, pupa or even an egg and should have an adult associated with it. However, it is only rarely or never that an insect species is described from an egg. When using paedotype, it seems necessary, from Hopkins definition, to use a qualifying adjective to indicate whether the type is an egg paedotype, a larval paedotype or a pupal paedotype. The terms nepionotype and neanotype are more specific and if species must be described from immature forms the *neanotype* will definitely indicate a pupal type. Since there is no way of distinguishing a larval type from a type that is described from a nymph the term *nymphotype* is here suggested for species that have paurometabolic development.

Fernald's type list (*l.c.*) cites 108 terms used in the designation of types. Many are synonyms. Commenting on the matter he writes that "entomologists may find themselves buried in a chaos of this phase of terminology." Pertinent to the naming of types for immature insects he further comments, "with two exceptions (meaning nepionotype and neanotype) all these terms relate in some way to the adult except possibly in palaeontology. But Pandora's box has many more which may escape. At any time some worker may describe the hitherto unknown egg and mark it some kind of type: equally, newly described specimens of naiads

in each of their many instars (45 or more in some species), nymphs, larvae and subimagos may become the bearers of different kinds of type names. There is no rule to prevent this. This enormous number of naiad, nymph and larval instars available insofar as none of them have previously been described, needs only a few workers with the "mihi itch" to deluge the nomenclatural field with a flood of new type names." He further mentions the possibilities of new type names with the discovery of such things as new leaf-mines and new insect galls. He overlooked cocoons, cases, callows, pronymphs, castes and a host of other possibilities. These obviously must be described but whether type designations are necessary is questionable to the present writer even though he has become infected with the "mihi itch" in his proposal above of the term *nymphotype*. Obviously, he needs a good dusting with DDT before the itch becomes severe.

In the matter of labeling immature specimens to indicate their status as to the manner in which they were determined, Van Emden (1922, Ent. Jahrb. for 1923, p. 102) suggested certain designations to be used on labels and later (1942, Tr. Roy. Ent. Soc., Lond., 92: 6) further discussed the subject. Since eggs, larvae, pupae and nymphs may be determined in a number of ways, an indication of the *manner of determination* should be noted on the identification label. This will give some notion as to the reliability of determination. Obviously, the most reliable method is to rear the immature form to the adult stage and then identify it. This procedure is time-consuming and often results disastrously when specimens die before they reach maturity.

The starting point in such rearings can begin at one of the several life stages. If a known adult is allowed to lay eggs the resulting larvae and pupae (or nymphs) are thus associated with the known adult. For specimens thus bred, Van Emden suggested the term *"determinato ex ovipostione"* which can be abbreviated *det. ex ovip.* Specimens that are reared from unknown nymphs or larvae to adult and then determined may be designated *"determinatio ex evolutione imaginis"* (*det. ex evol. imag.*) This method requires individual rearing because of the danger of having immature cultures that might be mixed; that is, composed of more than one species. Often characters of an adult may be recognizable in the pupa. Hayes and McColloch (1920, Ann. Ent. Soc. Amer., 13: 77) showed that in late pupal life the genitalia of adult beetles of the scarabaeid genus *Phyllophaga* (*Lachnosterna*) can be recognized through the pupal integument. Larval exuviae associated with

such pupae can thus be identified by their genitalia and often by other structural pupal characters that are common to the adult. For the designation of such larvae, Van Emden would use the phrase *"determinatio ex futura imagine"* (*det. ex fut. imag.*). Ross (1944, Bull. Ill. Nat. Hist. Survey, Vol. 23, p. 17) has recently made extensive use of this method of determination for both larvae and adults of Trichoptera. He speaks of it as "association by pupal dissection" and comments as follows: "In all caddis fly groups the larval sclerites are packed into the posterior end of the pupal chamber after the pupa is formed. Later in pupal life the adult structures take definite form within the pupal skin, and just before actual escape of the pupa, the complete adult may be teased out of the pupal skin. Such pre-adult specimens show all adult characters except those of wing venation . . . of greatest importance is the fact that the genitalia of both sexes become completely formed, hardened and colored before emergence of the adult."

"If, then, a cocoon or case is collected which has a mature pupa in it, the larval sclerites and fully formed genitalia are associated, and it is possible thus to link the adult and larval forms of the species." He points out that Vorhies (1909) and Milne (1938) have also used this method of association. Ross also states that while it may be necessary sometimes to make repeated collections in an area before certain species can be associated, he has found it "more satisfactory than cage rearing because of extreme cannibalism developed by caged larvae."

As we gradually increase our knowledge of the taxonomy of immature insects, more keys and descriptions become available and in many groups it is now possible to make rather certain determinations from characters of the immature forms themselves. Specimens so identified may be labeled *"determinatio ex systemate"* (*det. ex syst.*). Often such keys are only available for generic determination. It is possible, in those genera that have but a few included species, to use available descriptions for specific identifications and of course in a monotypic genus the generic key is all that is needed.

Identifications made in any of the above ways will, in great part, be based on structural characters. However, it often happens that identifications can be made by the use of less tangible characters. Such factors as distribution, habit, manner of life or even size can be helpful. These are circumstantial or ecological characters and not morphological. Association of a larva with its favorite food can lead to recognition but this is a somewhat unsafe method of

identification. There are instances where known distribution is helpful. As an example only two species of the beetle genus *Nosodendron* are known in the United States. One species, *N. unicolor* Say is found in the eastern states and *N. californicum* Horn is from the west. The identification of either species of larvae, when the genus is known, can be made from its distributional data. Other conditions, such as occurrence on an island, an alpine habitat or in caves, can also lead to recognition. Such identified forms may be labeled *"determinatio ex patria"* (*det. ex pat.*). The habitat can lead to a determination of more or less value. For example, the syrphid-fly larva (*Volucella*) which lives symbiotically in the nests of ants, when determined, may be labeled *"determinatio ex symbiosi"* (*det. ex symb.*). On the basis of its habitat it may be marked *"determinatio ex domicilio"* (*det. ex dom.*). Nymphs of certain Coccidae and larvae of other forms such as inquilines found in ant colonies or *Zoraptera* nymphs in termite colonies may be designated as *"determinatio ex societate imaginis"* (*det. ex soc. imag.*). Furthermore, certain gall-forming species or other inhabitants of galls can be marked *"determinatio ex cecido"* (*det. ex cecid.*). Certain immature ecto- and entoparasites, such as larvae of the screwworm fly or sheep nose bot or nymphs of the hog louse are readily identifiable from their hosts and their method of recognition may be noted as *"determinatio ex hospite et sede"* (*det. ex h. et s.*). In a limited way, certain forms can be placed by their size. This may happen when the size of the adult or a certain instar is known. Then the label may read *"determinatio ex magnitudine"* (*det. ex mag.*). Lastly, the time of appearance or occurrence can lead to a time factor for recognition and the label may read *"determinatio ex tempora"* (*det. ex temp.*). As indicated above, Van Emden has proposed these terms, all of which first appeared in the German publication (1922) cited. In his recent English paper (1942) not all of these terms are discussed. This then should bring them to the attention of American workers. The adoption of this system of labeling, if used more generally would facilitate labeling. However, it has not been generally adopted although proposed over twenty years ago. In the writer's experience of handling thousands of vials of immature forms that have been named by various investigators he has never seen Van Emden's terms or abbreviations used.